**Chemical Processes : Distribution coefficients of 50+ elements on newly synthesized Inorganic resin**

**Review Date:**

**Location of work**: building 801, Room 2-37 (shared with the Nuclear Chemistry Summer School)

- The studies will not use radioactivity.

**Purpose of experiments:**

The purpose of this experiment is to measure the distribution coefficients (*Kd*) of a large number of cold elements (periodic table page 1) at different pH ranges in nitric, hydrochloric acids, sodium acetate or other aqueous buffer on different inorganic ion-exchangers that have been synthesized in our laboratory. The synthesis of these resin were submitted and accepted in the proposal named: Synthesis of inorganic ion-exchange materials hydrothermally (presented by Dr. Dimitri Medvedev).

**Hazards and controls associated with the work:**

**Chemical Hazards:**

- **Existing hazards:**
  - Corrosive, oxidizers (strong acids and base).
  - Chemical burns, ingestion, inhalation, absorption through skin.

- **Default controls:**
  - General PPE to include cotton lab coat, safety goggles, and impermeable gloves when handling chemicals.
  - All the operations with a 250 ml of volumetric hazardous chemical quantities in hood.
  - Register commercial chemicals in CMS
  - Work alone after hours only if permitted by supervisor
  - Food, beverage, smoking and cosmetics are prohibited.
  - Unobstructed access to emergency Eyewash and shower.
  - All the used elements are non-radioactive and of improved chemical grads.
  - Spills: Small spills can be absorbed in paper towels moisten with water. Larger spills can be absorbed in clay absorbent material.

**Experimental procedure:**

1. Prepare 0.5M sodium acetate solution with a different pH range (between ~0 and 12).
2. Into the previously prepared solutions add a definite amount from the selected element.
3. Weight $\boldsymbol{m_x}$ grams of the selected resin in 16 mL polypropylene conical vials (with a stopper).

4. Pour the aqueous phases $\boldsymbol{V_x}$ into the vials containing the resin and shake for definite time t (typically 24-48 hours).
5. Separate the aqueous phases by using micro filter (0.22 µm) or by centrifugation.
6. Dilute ($D_x$) the aqueous phase in 2% $HNO_3$.
7. The non-radioactive samples in test tubes will be removed from room 2-37, and ICP-OES will be performed in the RRPL to determine the metal concentration.
8. The metal concentration in the initial aqueous phase before shaking ($\boldsymbol{C_i}$) and after shaking ($\boldsymbol{C_a}$) will be calculated.
9. Calculate the distribution coefficient using the following equation:

$$Kd = ((C_i - C_a)|C_a) * (m_x|V_x)$$

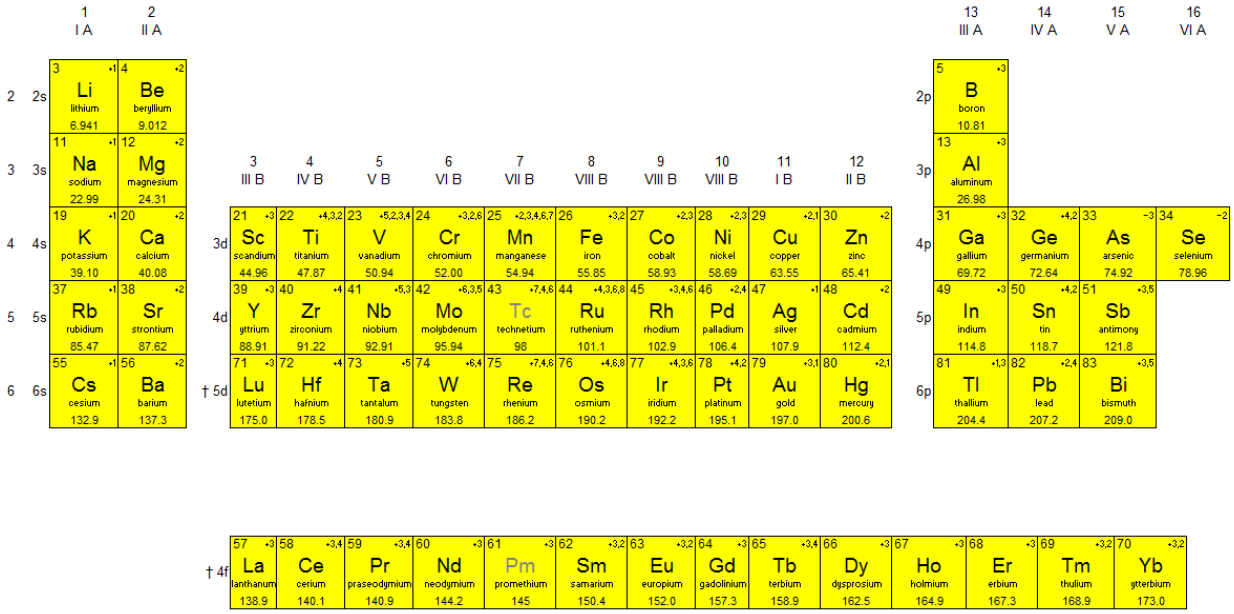
**Materials Used:**

**Ion-exchangers:**

- Sodium nonatitanate ( SNT), Sodium titanium silicate ( CST), Alpha zirconium phosphate (α-ZrP), Titanosilicate with pharmocosiderate like structure (TSP)

**Equipment/solutions**

Shaker, pipettes, pipette tips, single element standards for ICP, ICP tubes, tubes used in the study, hydrochloric acid, Nitric acid, Sodium Acetate, pH meter, balance, centrifuge, filters




PI Signature Completion of all action Items: _____ Date:____

Approval of ESRC to start: Michael Diwert Date: 4/19/16

Approval of ESSHQ to start: _____ Date:

## Chemical Processes

## Distribution coefficients of 50+ elements on newly synthesized Inorganic resin

### WORK PERMIT SIGN OFF SHEET

Signature implies that the worker understands the scope and limitations of the Work Permit and training is kept current.

| Print Name | Signature | Date | Process Review /Date |
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